GLDC gene

glycine decarboxylase

Normal Function

The *GLDC* gene provides instructions for making an enzyme called glycine dehydrogenase. This enzyme is one of four components (subunits) that make up a large complex called glycine cleavage enzyme. Within cells, this complex is active in specialized energy-producing centers called mitochondria.

As its name suggests, glycine cleavage enzyme processes a molecule called glycine by cutting (cleaving) it into smaller pieces. Glycine is an amino acid, which is a building block of proteins. This molecule also acts as a neurotransmitter, which is a chemical messenger that transmits signals in the brain. The breakdown of excess glycine is necessary for the normal development and function of nerve cells in the brain and spinal cord.

Health Conditions Related to Genetic Changes

glycine encephalopathy

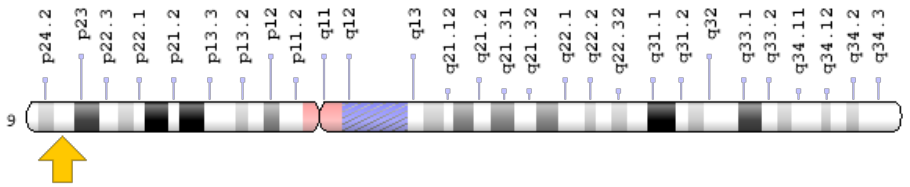
Mutations in the *GLDC* gene account for about 80 percent of all cases of glycine encephalopathy. More than 40 mutations have been identified in affected individuals. Many of these genetic changes alter single amino acids in glycine dehydrogenase. For example, the most common *GLDC* mutation in the Finnish population replaces the amino acid serine with the amino acid isoleucine at position 564 in the enzyme (also written as Ser564Ile or S564I). Other mutations insert or delete genetic material in the *GLDC* gene, or disrupt how genetic information from the gene is spliced together to make a blueprint for producing glycine dehydrogenase.

Some *GLDC* mutations lead to the production of a nonfunctional version of glycine dehydrogenase, while other mutations reduce but do not eliminate the enzyme's activity. When an altered version of this enzyme is incorporated into the glycine cleavage enzyme complex, it prevents the complex from breaking down glycine properly. As a result, excess glycine can build up to toxic levels in the body's organs and tissues. Damage caused by harmful amounts of this molecule in the brain and spinal cord is responsible for the intellectual disability, seizures, and breathing difficulties characteristic of glycine encephalopathy.

Chromosomal Location

Cytogenetic Location: 9p24.1, which is the short (p) arm of chromosome 9 at position 24.1

Molecular Location: base pairs 6,532,464 to 6,645,692 on chromosome 9 (Homo sapiens Annotation Release 108, GRCh38.p7) (NCBI)



Credit: Genome Decoration Page/NCBI

Other Names for This Gene

- GCE
- GCSP
- GCSP_HUMAN
- glycine cleavage system protein P
- glycine decarboxylase P-protein
- glycine dehydrogenase (decarboxylating)
- glycine dehydrogenase (decarboxylating; glycine decarboxylase, glycine cleavage system protein P)
- HYGN1
- NKH

Additional Information & Resources

Educational Resources

- Basic Neurochemistry (sixth edition, 1999): Nonketotic hyperglycinemia is caused by deficiencies in the glycine-cleavage system https://www.ncbi.nlm.nih.gov/books/NBK27969/
- Nomenclature Committee of the International Union of Biochemistry and Molecular Biology: Glycine Cleavage System http://www.chem.qmul.ac.uk/iubmb/enzyme/reaction/AminoAcid/GlyCleave.html

GeneReviews

- Glycine Encephalopathy
  https://www.ncbi.nlm.nih.gov/books/NBK1357

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28GLDC%5BTIAB%5D%29+OR+%28glycine+dehydrogenase%5BTIAB%5D%29%29+OR+%28glycine+decarboxylase%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- GLYCINE DECARBOXYLASE
  http://omim.org/entry/238300

Research Resources

- Atlas of Genetics and Cytogenetics in Oncology and Haematology
  http://atlasgeneticsoncology.org/Genes/GC_GLDC.html
- ClinVar
  https://www.ncbi.nlm.nih.gov/clinvar?term=GLDC%5Bgene%5D
- HGNC Gene Symbol Report
  http://www.genenames.org/cgi-bin/gene_symbol_report?q=data/hgnc_data.php&hgnc_id=4313
- NCBI Gene
  https://www.ncbi.nlm.nih.gov/gene/2731
- UniProt
  http://www.uniprot.org/uniprot/P23378

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https://ghr.nlm.nih.gov/gene/GLDC

Reviewed: April 2007
Published: March 21, 2017

Lister Hill National Center for Biomedical Communications
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